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A study on the Hadley circulation changes under global warming

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The impact of greenhouse gas increase on the atmospheric large scale circulation is analyzed using the Coupled General Circulation Model (CGCM) simulations carried out in the framework of the Fourth Assessment Report (AR4). In the conditions of a doubling in the carbon dioxide concentration, the CGCMs participating to the AR4 show a weakening of the Hadley circulation for the winter cell in both hemispheres, accompanied by a poleward extension of the Hadley circulation area. The conditions explaining this weakening of the Hadley circulation are analyzed using detailed outputs from the IPSL-CM4 model. It can be seen first as a response to the global SST changes, triggering a modification of the dry static stability of the tropical atmosphere, and, secondly as a response to the changes in the latitudinal gradient of the SST, which increase the baroclinicity in the mid-latitude regions.